

Black-necked Cranes *Grus nigricollis* in Bhutan: migration routes, threats and conservation prospects

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Black-necked Crane *Grus nigricollis* is a globally threatened species, of which a few hundred individuals winter in Bhutan. The species has been monitored on its wintering grounds in Bhutan since 1987, but little is known about migration routes or about threats during migration and wintering. In this study, we conducted interviews with local people at wintering sites and potential stopover sites to identify movement patterns and to prioritise threats to the conservation of this species. We found that several of the causes of cranes disappearing from former wintering areas are still prevalent in the current wintering areas; these are apart from the addition of many new threats. One of the main threats is loss and degradation of wetland habitat from development and agriculture. We consider habitat protection to be of highest priority in conserving the species. Our study also identifies four migration routes (Gasa, Lhuntshi, Trashi Yangtse and Paro) and six stopover areas (Gasa, Tshokhana, Dungkhar, Bapton, Tangmachu and Shengana) used by the cranes during their migration in and out of Bhutan in winter.

INTRODUCTION

Many cranes across the world are threatened with extinction. Among these, one of the least known is the Black-necked Crane *Grus nigricollis*, which is currently classified as Vulnerable (BirdLife International 2009). In the Himalayan country of Bhutan, Black-necked Cranes visit several wintering grounds, arriving from China's Qinghai-Tibetan Plateau from early November to mid-December, and remaining until mid-February. Since this species is well-known among the people of Bhutan, the annual migration of Black-necked Cranes to Bhutan is an event of both biological and cultural importance.

Many conservationists believe that there may have been a historical decline in Black-necked Crane numbers due to human activities (Bishop 1996, Meine and Archibald 1996, BirdLife International 2001) although more recent work suggests that numbers in China may be increasing (Bishop *et al.* 2007). In Bhutan, trends in crane numbers are unclear (Lhendup 2007). However, casual observations and monitoring data (Royal Society for the

Protection of Nature, unpublished data) show that cranes from two former wintering sites in Bhutan have disappeared, and that some wintering grounds may not have stable populations. At present there are five known wintering grounds in Bhutan (Fig. 1) and three abandoned wintering grounds. It is commonly believed that human activities are responsible for the abandonment of these three locations. Migratory crane populations in Bhutan may be negatively affected by human activities in several ways. Settlement expansion, land development and farm mechanisation are considered threats to the survival of cranes, as well as the loss and degradation of habitat from other causes (Bishop 1996, Meine and Archibald 1996, BirdLife International 2001, International Crane Foundation 2004).

Planning conservation actions for a migratory bird requires two sources of information. First, it is imperative to understand migratory routes, so that conservation action can be implemented in appropriate places to make the greatest positive impact. Second, it is necessary to understand the threats to the species at both the wintering grounds as well as along migration routes.

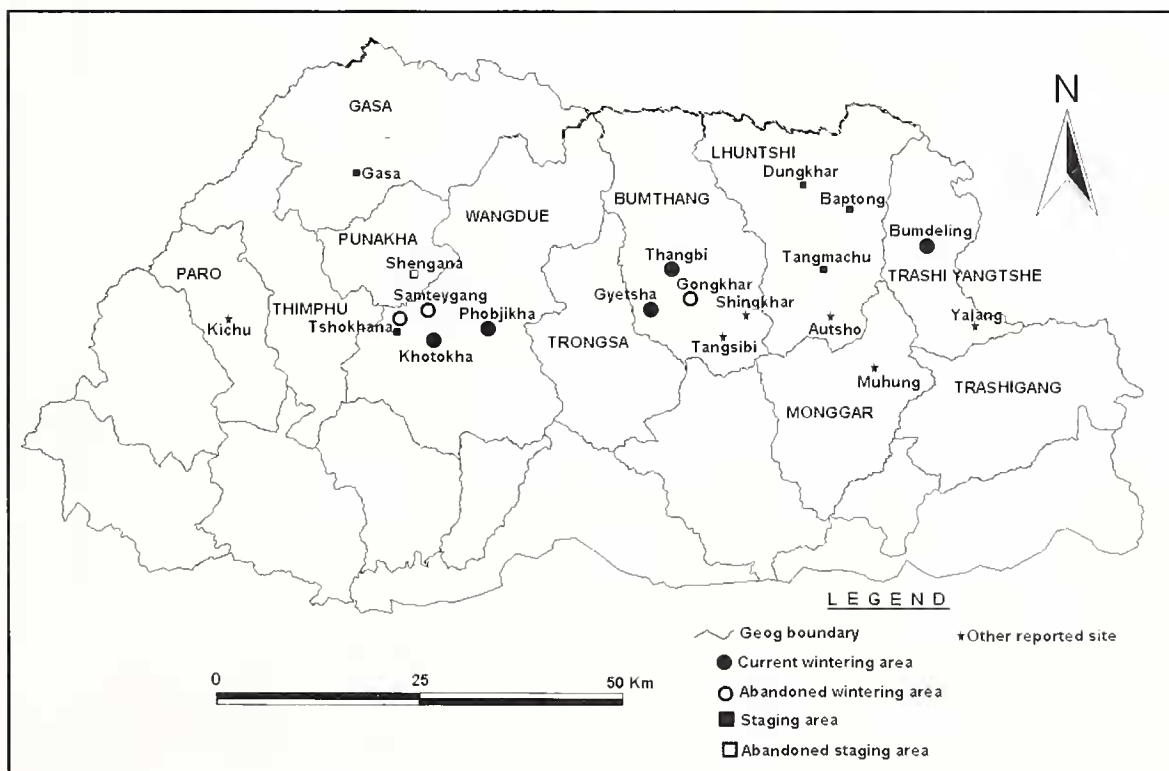


Figure 1. Map of past and present Black-necked Crane wintering sites in Bhutan.

Although monitoring of Black-necked Cranes in Bhutan has taken place since 1987, this monitoring has only been done, for logistical reasons, at the wintering grounds. While this is the most crucial long-term data for monitoring, it is also necessary to understand the movements of the cranes through migratory routes (routes within Bhutan to arrive at the wintering grounds) and stopover areas. This information is important because birds can be affected by human activities all through the migratory path as well as at the wintering grounds. To date, however, efforts to map the migratory routes using radio tracking and satellite telemetry have not been successful (Dietzman and Mirande 1998).

Once migration routes and wintering grounds have been identified, it is necessary to document the extent, degree and types of threats to cranes in these locations. This has not yet been fully done in Bhutan. Arriving at a definitive list of threats to cranes is complex and, from a biological perspective, probably impossible in a short timeframe. However, the most important threats are often obvious, and in assessing these, local ecological knowledge of rural inhabitants who observe cranes annually can be very helpful.

In this study, we used questionnaires and interviews to garner information from local people to meet three objectives: (1) map wintering habitats, migratory routes and stopover areas of Black-necked Cranes in Bhutan; (2) compile and analyse the threats to past and current crane populations; and, (3) provide a list of prioritised crane conservation measures.

METHODS

To map the migratory routes of Black-necked Cranes, 18 sites across Bhutan were visited from June to December 2006. Cranes had been observed at least once at each of these sites (Fig. 1). At each site, we interviewed local people to document their observations on crane behaviour, length of stay at the site, and the direction of flight when arriving and departing. This information was used to map migratory routes and stopover areas outside the wintering grounds. A total of 68 people were interviewed. Informants were conservation officials and local people who had observed or knew about the cranes.

To document local people's perceptions of crane population trends and threats to the species, we held focus-discussion groups at all current and former (i.e., abandoned) wintering areas. Discussion groups ranged in size from nine to greater than 20 persons, with an effort made at each site to have a minimum of 20 participants. In total, 93 villagers participated in the discussion groups, 51 male and 42 female, aged 21 to 76. At the abandoned sites, the numbers of participants were 8 in Tshokhana, 9 in Samteygang and 21 in Gongkhar. Discussions at these three sites focused on the historical changes that may have been responsible for the decline and disappearance of the cranes at those sites. At the current wintering areas, there were 22 participants in Phobjikha, 23 in Bumdeling, 16 in Khotokha, 20 in Gyetsha and 12 in Thangbi. Focus-group discussions at these five sites centred on the possible threats that might be affecting existing populations, and on recommendations for possible conservation measures.

During the group discussions, threats to the cranes were listed, discussed and then scored according to

importance (following Bishop 1996). The scoring system was the same at both abandoned and extant wintering sites. *Critical threats* (scored as 3) were those considered to be major threats in terms of disturbance and interference with the cranes and, in the opinion of participants, needed immediate action. In abandoned sites these were factors that participants considered the most likely causes of local extirpation. *Significant threats* (scored as 2) were important, though not considered as unambiguous as critical threats in terms of why the cranes may have abandoned past sites or may be declining in present sites. *Lesser threats* (scored as 1) were considered detrimental in some localities or for some populations, but without a Significant or Critical impact on the species. Based on the group discussion, we produced a matrix of possible responsible threats and their rankings. The threats from the two different types of wintering sites (former and current sites) were compared to judge how threats may have changed in quality and intensity.

At each current wintering area, the discussion group was asked to propose conservation measures for each of the threats, based on their combined opinion. This was done so that threat-specific actions could then be used to promote conservation action both locally (site-specific) and at the regional or national level.

RESULTS

Migratory routes and stopover areas

We identified four migration routes and confirmed six stopover areas based on our interviews with local people. Most routes occur along river valleys (Fig. 2).

For cranes entering Bhutan from the West, Paro and Gasa appear to be the major migratory routes (Fig. 2), with the Gasa route being the more important of the two, as inferred from the interviews and sighting information. For example, cranes wintering in Khotokha and Phobjikha have been observed to use the Gasa route for both autumn and spring migration. Gasa is a well-used stopover area, with cranes being reported to spend around two weeks here towards the end of October. In contrast, people interviewed along Paro routes had little knowledge about the movements of Black-necked Cranes. A sighting of a lone Black-necked Crane near Paro (Kichu) in January 2003 was reported in local news (Kuensel Online 2003). Local people told us that they thought this individual was probably lost and had strayed away from the main group while migrating. In 2000 six cranes were seen flying east over Paro in November (P. van der Poel and P. Lhendup, unpublished). Thus, it appears reasonable to conclude that only a small number of cranes use the Paro route along the Pa Chu river, with most cranes that enter from the west following the Gasa route. Cranes entering through the Paro or Gasa routes appear to winter in Gyetsha. Local people in Gyetsha reported cranes arriving from the west in the autumn. A study by the Royal Society for the Protection of Nature reached a similar conclusion (Wetlands International 2007). Apart from Gasa, cranes were reported to stop over in Tshokhana for about a week towards the end of October. Shengana was reported to be a former stopover area, now abandoned by cranes.

Cranes entering from the north-east of Bhutan use either the Lhuntshi or Trashi Yangtshu routes (Fig. 2). Most cranes that winter in Bumdeling utilise the Trashi

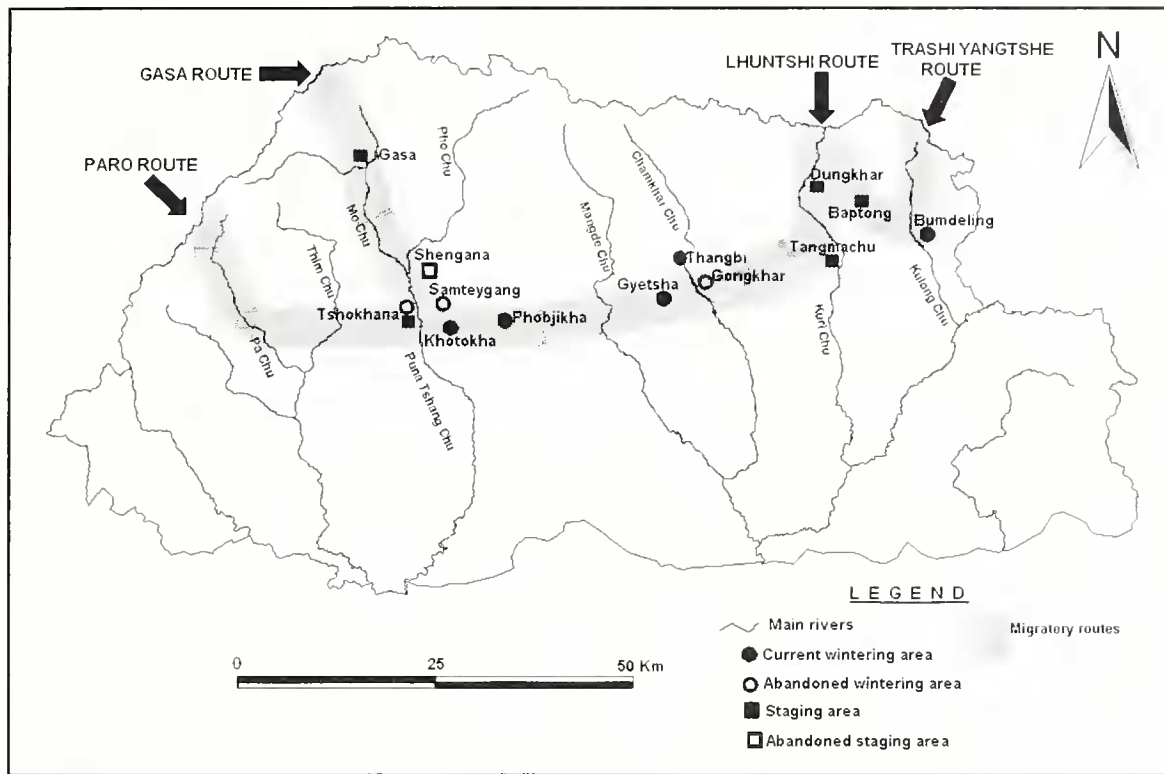


Figure 2. Migratory routes of Black-necked Cranes in Bhutan.

Yangtshe route along Kuri Chu and Kulong Chu. Three stopover areas are located along this route: Dungkhar, Bapdong and Tangmachu. The cranes were reported to spend about 15 days in each of these stopover areas in November.

Black-necked Cranes have been observed as vagrants at six other locations in Bhutan (Fig. 1). At these locations, most references by local people were to a single individual in the past. In Muhung, local residents said that they found a roost site in 2000, which was subsequently abandoned.

Threat analysis: former wintering areas

Cranes in Tshokhana disappeared around 40 years ago, so younger people in these areas had no knowledge of them. Similarly, Samteygang had always been a minor wintering ground, and their presence and subsequent disappearance in 1994 was not known to many local people. Local people in Gongkhar recalled the appearance of cranes around the late 1970s, about the same time that cranes started disappearing from Tshokhana. About 20–30 cranes were reported to have occurred in Gongkhar; these stopped coming 10–12 years after they first appeared. It is possible that these may have been cranes from Tshokhana. In general, low participation in our discussion groups at abandoned sites suggests that there has been a loss of

ecological knowledge, and perhaps even tradition, in those sites that used to be a temporary home to migratory cranes.

Across these three abandoned wintering areas, land use change involving land development and expansion of settlements was consistently cited as a Critical factor leading to crane disappearance; it had the highest total score and was the only factor listed at all three abandoned wintering sites (Table 1). An increase in the human population and, most importantly, development activities that claimed habitat through the construction of houses, schools, shops and roads were described as the reason for these changes.

Changes in agricultural practices, too, were considered to be highly influential in leading to the disappearance of cranes (Table 1). In traditional farming practices, fallen grains of barley and paddy are left in the fields after harvesting in early winter, and these were described as providing important food for cranes. With development, the land area under agriculture has declined, reducing food availability. Crop changes, such as the addition of potato as a winter crop in Gongkhar, were described as causing a similar decline in food availability.

Hunting, livestock grazing, and stray dogs were also described as having led to crane disappearance (Table 1). Hunting in Tshokhana’s crane areas was claimed to have coincided with the arrival and settling of exiled Tibetan

Table 1. Threat scores of Black-necked Cranes in Bhutan.

Threats	Former wintering areas			Current wintering areas				
	Tshokhana	Gongkhar	Samteygang	Phobjikha	Bumdeling	Khotokha	Gyetsha	Thangbi
Land use change through settlement expansion and land development	3	3	2	2	3			
Changes in agriculture practices	3	3			2			
Hunting	3							
Livestock grazing	1	2		1	1	1	1	
Stray dogs	1	1		1	2	1	1	1
Predators	1	1		1	1	1	1	1
Tourist and outside visitor				2	2	1	1	
Sound of vehicle movement				2	1	2		
Other minor threats					17			

refugees in the late 1950s and early 1960s which was followed by increased hunting by both Tibetan and Bhutanese residents in the area.

Threat scores: current wintering areas

Based on the ranking of various threats discussed in the five current wintering areas it appears that cranes wintering in Bumdeling face a much larger set of threats than those at other sites (Table 1). Phobjikha ranked second, followed by Khotokha. Thangbi was the least disturbed site according to this ranking. Only one threat—land use change through settlement expansion and land development—was ranked as Critical, and only in Bumdeling. All other threats were listed as Significant or Lesser. The majority rankings were of Lesser threat, suggesting that most wintering areas were fairly undisturbed. Interestingly, although predators were described as being present in all the areas, their effects on the cranes were considered minimal and they were described as being part of the ecology of the system. Bumdeling had a long list of other threats that were not listed at the other sites (Table 1).

Conservation measures: community perspective

In relation to the threats identified, conservation measures were suggested by local people during the group discussions. People in Bumdeling and Phobjikha were of the opinion that the government should ban construction activities and settlements that intrude into crane habitat. In addition, they argued that prior to any construction activities, an impact assessment should be conducted, which should be closely integrated with the process of issuing a government permit for construction. They also suggested that any tourists or visitors wishing to watch cranes should be required to obtain a permit, and visitors be accompanied by guides to monitor their movements.

Winter cropping is banned in Bumdeling by the Government, so that the farmland can serve as feeding ground for the cranes that feed on left-over paddy in the fields after harvest. Local people said that they should be compensated for the economic losses resulting from not being allowed to sow a winter crop. To control disturbance from vehicle movements, they suggested that town expansion should not create parking spaces near crane habitat, and that drivers should be educated on crane conservation. Similarly, local people in Phobjikha suggested that there should be strict monitoring by the RSPN to prevent vehicles from moving close to the crane habitat; signboards would contribute to this goal. Local people in all the areas surveyed were of the opinion that measures should be initiated to reduce the number of stray dogs.

DISCUSSION

The fate of migratory cranes depends upon the availability of high-quality habitat, and in Bhutan there is a lack of knowledge of vital stopover areas and migratory routes and their importance in migration. Stopover areas along migration routes are likely to be important in providing shelter, water, and food for replenishment of energy reserves. In the absence of detailed information on the behaviour of cranes at their stopover areas and the consequence for the population if these areas were to become unsuitable, caution would dictate that conservation

effort be expended at these areas. Regular and systematic monitoring of stopover sites could be coordinated by the forestry officials and local people. Land-planning agencies and organisations should be provided information on heavily used migration routes and stopover sites so that these can be given special protection.

Although more information is needed on migration routes and stopover areas, this should not detract from an emphasis on conservation on the wintering grounds. Based on perceived threats in former and current wintering areas, it appears that the most critical factors (in particular, change in land use) responsible for the disappearance of cranes from the former wintering areas still prevail in the current wintering areas. This could mean a future decline in numbers of cranes in Bhutan if appropriate conservation measures are not adopted. Threats from the expansion of settlements, ranked as Critical in former wintering areas, still persist in Bumdeling and Phobjikha. To deal with this threat, the Government of Bhutan should adopt new policies, including banning construction and settlements that intrude into crane habitat, and carefully monitoring all construction works in wintering areas, especially those using dynamite detonation. Similarly, while evaluating applications for forest clearance for construction, the National Environment Commission should give a high priority to protecting crane flight paths, stopover and overwintering areas.

Of the two major wintering areas in Bhutan, threats to cranes appear to be higher in Bumdeling than Phobjikha. Threats from settlement expansion and disturbance by stray dogs are higher in Bumdeling and changes in agriculture practices and several other minor threats mean that the habitat in Bumdeling is under great pressure. Vehicular movement appears to be a greater problem in Phobjikha, while disturbance from tourists, livestock grazing and predators poses similar threats in both these wintering areas.

The number and extent of threats to cranes appear to have increased over the past few decades, suggesting that a comprehensive programme to address the conservation needs for cranes is urgent. Such a conservation action plan would be national in scope and would prioritise research and conservation activities. Our study suggests that information available with local people is often very useful and should be incorporated into monitoring and conservation planning. Below, we suggest some additional important components of such a plan.

(1) Improve awareness of the Black-necked Crane's ecological, cultural and religious value. Threats from changing agriculture practices are still prevalent in Bumdeling, as also in the abandoned wintering grounds of Tshokhana and Gongkhar. The root cause of this threat is profit-oriented winter cropping despite the ban, where farmers grow mustard and other vegetables, rather than leaving their land fallow in the winter. Clearly, a halt to winter cropping would be looked upon unfavourably by farmers, as conservation would not provide the economic returns to compensate for lost income. Yet Bhutan's Middle Path strategy of development supports the maintenance of biological diversity while allowing for sustainable livelihoods. An awareness of the ecological, cultural and religious value of cranes needs to be improved, such that the non-monetary value of cranes does not diminish over time.

(2) Implement agricultural subsidies for farms that are located in areas that are demonstrated to be important

crane habitat. Subsidies could be used to pay farmers to not cultivate their land, so that the habitat could be utilised by the cranes in winter. The Government of Bhutan has, for example, implemented a policy of paying for livestock losses due to natural predators like tigers and leopards. An agricultural subsidy, as suggested here, would require a substantially larger investment.

(3) Regulate tourist access to cranes. Though eco-tourism is widely believed to be an environmentally friendly activity, local people in our discussion groups reported that it was a threat to the cranes when practised improperly. In attempting to take photographs, tourists often approach and disturb cranes (e.g., in Phobjikha: Chacko 1998), and they often wear conspicuous clothing. Clearly ecologically appropriate crane-watching rules need to be enforced. A permit system for tourists or visitors wishing to watch cranes could improve compliance with such rules. Finally, requiring the use of local guides might help to reduce the disturbance cranes face from visitors.

(4) Strengthen educational programmes for the general public and focusing on students, teachers, policy makers and communities that depend on wetlands that serve as habitat for the cranes. An education programme like the one adopted in Phobjikha (where there is an annual crane festival) should be replicated. Emphasis in these programmes should be placed on the effects of land use change on crane habitat, both along migration routes and on wintering grounds.

(5) Study crane food requirements and how food resources are affected by agricultural practices. Eurasian Cranes *Grus grus* in south-west Spain appear to obtain a more balanced diet from natural sources (acorns, bulbs, invertebrates) than from agricultural fields alone (Guzmán *et al.* 1999). On the other hand, a study of Black-necked Cranes wintering in Tibet (Bishop *et al.* 1998) showed that agricultural land contributed significantly to food availability. Further research is needed to determine the contribution of agricultural land towards food for the cranes, and the impact of winter cropping on crane feeding habitats. This could lead to improved cropping techniques or, more broadly, policy to support non-cropping schemes in Bhutan.

(6) Monitor cranes systematically and comprehensively. At present, crane monitoring is insufficient for the task at hand. Increased intensity in monitoring should accompany more systematic efforts in gathering, organising and disseminating data. Professional training in crane surveys, monitoring techniques and emerging concepts of ecosystem-based wetland management could be carried out through collaborative programmes with national and international organisations.

(7) Encourage cross-border conservation efforts between Bhutan and China, which should cooperate in sharing information so that crane conservation can be planned in a more holistic manner. Since the conservation of a migratory species will depend on efforts at breeding grounds, migration routes, and wintering areas, a comprehensive conservation plan for the Black-necked Crane should involve both China and Bhutan, as well as other countries within the range of the species.

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